

REMARKS/ARGUMENTS

Claims 1-11 are pending herein.

1. Claims 1, 2 and 9-11 were rejected under §103(a) over Chiu in view of Bernier. This rejection is respectfully traversed.

Claim 1 recites a heat spreader module, comprising a base, a heat spreader member joined on the base, and an insulating substrate arranged on the heat spreader member. The base includes a copper alloy which has a proof stress of not less than 45 MPa and a coefficient of thermal conductivity of not less than 270 W/mK when subjected to a heat treatment between 600° and 900°C for 10 minutes.

The base is joined to the heat spreader member through hard soldering. Applicants submit that hard soldering requires significantly higher temperatures than traditional soldering. The elevated temperatures place greater stresses on the parts attached by the hard solder. One option to safely counteract these higher stresses is to use higher strength materials. Unfortunately, when working with copper alloys, merely selecting higher strength alloys is insufficient, as the strength of a copper alloy is inversely proportional to the thermoconductivity of the alloy. Because thermoconductivity is a very important property for the heat spreader to exhibit, Applicants have invented a specific arrangement having a base with properties that manage stress relating to hard soldering while still functioning properly in conjunction with a heat spreader. Furthermore, Applicants have determined that the material properties recited in claim 1 must be present when subjected to a heat treatment between 600° and 900°C for 10 minutes (as recited in claim 1), as these are the conditions that will be present during the hard soldering operation.

As interpreted by the Examiner, Chiu discloses a base 80, a heat spreader member 60 joined on the base, and a substrate 50 arranged on the heat spreader member 60. Chiu discloses, in column 2, lines 26-29, that the heat spreader member 60 is "coupled" to the alleged base 80. Chiu does not disclose the attachment process

in greater detail than merely being "coupled." Therefore, Chiu does not disclose any attachment process that includes hard solder.

Bernier, used by the Examiner for its disclosure of a copper alloy heat spreader module 300, also fails to disclose the attachment of anything to the heat spreader using a hard solder. In fact, Bernier discloses, in column 4, lines 44-47, that the heat spreader 300 is attached to a mating part using a thin layer of silicone adhesive. As with Chiu, no connections have been disclosed that would use or need the benefits of a base being made from a copper alloy having the specific material characteristics recited in claim 1.

The Examiner stated that "it would have been obvious to one skilled in the art to select a copper alloy with as high a proof stress and thermal conductivity as feasible, that will suit the application, cost and function requirements, to improve the thermal performance and structural rigidity of the base." Applicants respectfully disagree for the following reasons.

First, as is shown in both Chiu and Bernier, those skilled in the art typically do not hard solder heat spreaders to a copper alloy base and thus do not require a base made of a special alloy having the mechanical characteristics recited in claim 1.

Second, the mechanical characteristics recited in claim 1 are for a copper alloy when it is subjected to a heat treatment of 600° to 900°C for 10 minutes. Contrary to the Examiner's understanding, this heat treatment is not a process in the manufacture of the copper alloy, but it is the temperature range and time with which the copper alloy must have the recited characteristics. This is important as the copper alloy bases of the present invention are joined to heat spreader members at these temperatures (i.e., through hard soldering). The material characteristics shown in the Examiner's references are representative of a copper alloy at room temperature, not at the elevated temperatures recited in claim 1.

Third, there is no disclosure within the cited prior art that the material properties for a copper alloy held between 600° to 900°C for 10 minutes, as recited in claim 1, are important or should be specified. There is also no motivation for one

skilled in the art to do so because the prior art does not disclose the use of a hard solder in a heat spreader.

For at least the reasons stated above, a heat spreader having a copper alloy base with the material characteristics recited in claim 1 would not have been obvious to one skilled in the art given Chiu and Bernier. Since claims 2 and 9-11 depend directly from claim 1, those claims are also believed to be allowable over the applied art. Accordingly, reconsideration and withdrawal of this rejection are respectfully requested.

2. Claim 7 was rejected under §103(a) over Chiu in view of Bernier and further in view of Tobita. Applicants respectfully submit that the arguments submitted above distinguish claim 1 from Chiu. Since Bernier does not overcome the deficiencies of Chiu, and since claim 7 depends directly from claim 1, claim 7 is also believed to be allowable over the applied art.

3. Claims 3-6 were rejected under §103(a) over Chiu in view of Bernier and further view of Ishikawa. Applicants respectfully submit that the arguments submitted above distinguish claim 1 from Chiu. Since Bernier does not overcome the deficiencies of Chiu, and since claims 3-6 depend either directly or indirectly from claim 1, claims 3-6 are also believed to be allowable over the applied art.

4. Claim 8 was rejected under §103(a) over Chiu in view of Bernier and further in view of Achari. Applicants respectfully submit that the arguments submitted above distinguish claim 1 from Chiu. Since Bernier does not overcome the deficiencies of Chiu, and since claim 8 depends directly from claim 1, claim 8 is also believed to be allowable over the applied art.

For at least the foregoing reasons, Applicants respectfully submit that all pending claims herein define patentable subject matter over the art of record.


Accordingly, the Examiner is requested to issue a Notice of Allowance for this application in due course.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

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Date


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